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Improvement of Health Care for Socially Disadvantaged Children with Cleft Lip and Palate Anomaly by Using Proper Radiologic Examinations

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Abstract

According to the Romanian legislation, the child is entitled to the highest standard of health attainable, and also to preventing situations that endanger life, growth and development. Children with cleft lip and palate (CLP) represent a socially disadvantaged group, with a tendency toward social inhibition, social anxiety and low self-esteem, due to their medical condition, facial appearance and speech difficulties. Radiation exposure is an essential aspect of the proper health care during all stages of surgical and orthodontic treatment, having a significant impact on CLP patients' quality of life. A survey was conducted among 104 residents training in four medical specialties, to assess the usage of proper radiologic examinations during CLP management. The results indicate the necessity to improve the physicians' level of knowledge regarding 3D imaging modalities, their awareness on the necessity of high quality health services for CLP patients - as socially disadvantaged children, and pediatric patients in general, but also on the effect of improper radiation on the quality of life.

Keywords: quality of health care, quality of life, socially disadvantaged children, radiation exposure, cleft lip and palate, questionnaire.

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Introduction

Health - as a field of which the primary concern is the human being, and its protection represents an international area of interest, directly conditioning the quality of life. According to the Romanian legislation (Law 272/2004, article 46), the child is entitled to the highest standard of health attainable, and also to preventing situations that endanger life, growth and development.

Cleft lip and palate (CLP), being a craniofacial anomaly, affects the physical wellbeing and the development of children presenting this condition, but also their social and emotional wellbeing (Mossey, Little, Dixon & Shaw, 2009) – four of the five dimensions of the quality of life, according to the definition given by Felce and Perry (Felce & Perry, 1995). Children with CLP represent a socially disadvantaged group, with a tendency toward social inhibition, social anxiety and low self-esteem, due to their medical condition, facial appearance and speech difficulties (Wyszysnski, 2002; Hunt, Burden, Hepper, Stevenson & Johnston, 2006; Piombino et al., 2014). Therefore, CLP patients require a multidisciplinary medical approach, the main goal being to offer the optimum patient care and to achieve the best possible treatment outcome (Jones, Sadove, Dean, & Huebener, 2011). Almost every physician involved in the complex management of CLP patients necessitates the use of multiple radiologic examinations for clinical purposes. This raises an ethical consideration: the need for careful judgment on radiation exposure of these pediatric patients, considering its significant impact on their quality of life (Holmberg, Malone, Rehani, McLean & Czarwinski, 2010; Slovis, 2011; Khong *et al.*, 2013).

During the last decades, CT has become a valuable tool with multiple clinical applications, increasing the rates of its use. This has led to relatively high radiation doses associated with CT scans, raising concerns for the pediatric patient's health and quality of life, potential risks, and the management of patient dose (Slovis, 2011; Goske *et al*., 2014). Cone beam CT (CBCT), as the latest three-dimensional (3D) imaging technique, provides a lower dosage of radiation exposure compared to the classic CT (Wortche *et al*., 2006; Silva, Wolf, Heinicke, Bumann, Visser & Hirsch, 2008; Ludlow & Ivanovic, 2008).

Therefore, the aim of this study was to assess the level of knowledge in this area among medical residents involved in CLP treatment through the means of a questionnaire and to address its impact on their patients' quality of life.

Materials and methods

A questionnaire was designed and applied to residents training in four medical specialties involved in CLP treatment: Pediatric surgery, Plastic surgery and reconstructive microsurgery, Oral and maxillofacial surgery, and Orthodontics and dentofacial orthopedics – at "Grigore T. Popa" University of Medicine and Pharmacy in Iasi, Romania. The content validity of the questionnaire was assessed by one expert in dentomaxillofacial radiology (Burns *et al.*, 2008). The questionnaire consisted in 3 sections and 10 items: (1) *The first section* (I1-3) contained personal data (age, sex, medical specialty); (2) The items of *the second section* (I4-6) targeted the residents' concepts on the necessity and the importance of 3D imaging, and also their indications of choice in CLP management, using multiple response questions; (3) *The third section* (I7-10) aimed to assess the residents' self-evaluation on their current knowledge regarding 3D imaging modalities. Simple Yes/No responses items were used, alternating with 5 point Likert scale items (options: *very low, low, medium, high, very high*).

The survey pretesting was conducted on a sample of 20 residents training in another similar medical specialty: Dentoalveolar surgery (Burns *et al.*, 2008; Krosnick & Presser, 2010; Stone, 1993). The pretesting resulted in small changes regarding enunciation, and the revised form of the questionnaire was then applied to the studied sample, consisting in 104 residents. Fifty-five residents agreed to participate in the testing phase, filling in the questionnaire that was distributed to them (Table 1). Before the testing, the respondents were encouraged to answer all items honestly, being ensured of the preservation of their anonymity. The retest phase took place by distributing the same questionnaire to the respondents, two weeks after their participation to the testing phase (Burns *et al.*, 2008). On the total of 55 participating residents, 33 agreed to respond to the second application of the questionnaire (*Table 1*). The filled in questionnaires in both test and retest phases were provided with a specific ID code for every participant, allowing the evaluation of test-retest reliability - a statistical technique that refers to the precision of measurement (Burns *et al.*, 2008).

Statistical analysis was performed using SPSS software version 16, to compare both applications of the questionnaire (test and retest). Three statistical tests were used, corresponding to the type of questions found under section 2 and 3 of the questionnaire: (1) The McNemar test, used to compare discordance of two dichotomous responses, was used for questions with multiple possible answers; (2) The Marginal homogeneity test, an extention of McNemar test, was used for single response questions; (3) Spearman correlation coefficient was used for Likert scale response questions.

Table 1: *Participating residents in test and retest phases*

	Values	Test	Re-test
Total	N	55	33
	%	100.0	100.0
Specialty			
Pediatric surgery	N	12	10
	%	21.8	30.3
Plastic surgery and reconstructive microsurgery	N	19	13
	%	34.5	39.4
Oral and maxillofacial surgery	N	11	1
	%	20.0	3.0
Orthodontics and dentofacial orthopedics	N	13	9
	%	23.6	27.3

Results

Test-retest reliability

The results of McNemar test and of the Marginal homogeneity test showed no significant difference between the two applications of the questionnaire for each participant.

Table 2. *Results of the McNemar test for multiple answer items, p=0.01*

Answers	Item 4	Item 6
1	1.000	1.000
2	0.453	0.250
3	0.774	1.000
4	0.727	1.000
5	1.000	0.125
6	0.549	0.092
7	0.125	*
8	0.065	0.021
9	0.500	1.000
10	-	1.000
11	-	0.500
12	-	1.000
13	-	0.070
14	-	0.549
15	-	*

*Answer chosen by none of the respondents

The Spearman correlation coefficient calculated for items 8 and 10 showed a good or strong correlation *(Table 3)*. The T-test values ($p<0.01$) showed a statistically significant correlation between test and retest results, with a confidence interval of 99% *(Table 3)*. These data attest the questionnaire's reliability and reproducibility.

Section I of the questionnaire

Out of 104 residents training in the selected medical specialties involved in CLP treatment, 55 agreed to participate in the present study, achieving a response rate of 52.88%. The participants' ages ranged from 25 to 41 years, with a balanced male/female distribution (about 4/5). The subjects' distribution on specialties is also balanced.

Table 3: *Test-retest reliability results for single answer items and Likert scale answer items*

	Spearman Coefficient[1]	Marginal Homogeneity Test[2]	T-test[1]
Item 5	-	0.782	0.000
Item 7	-	1	0.000
Item 8	0.942	-	0.000
Item 9	-	0.317	0.000
Item 10	0.804	-	0.000

[1] p=0.01 , [2] p=0.05

Section II of the questionnaire

When asked to choose imaging modalities they deemed necessary to prescribe during CLP management, participants chose both two-dimensional (2D) and 3D procedures. Nevertheless, CT was considered the most useful imaging modality by the majority of the respondents (58.2%), followed by CBCT (29.1%), pointing out the perceived importance of 3D imaging among residents (*Figure 1*). Fewer Plastic surgery and reconstructive microsurgery residents opted for CBCT as being a necessary imaging modality, compared to residents from the other three medical specialties. The same tendency was observed when opting for the most useful imaging modality in CLP management. In both occasions, a statistically significant difference was found (pairwise t-test, 95% confidence interval).

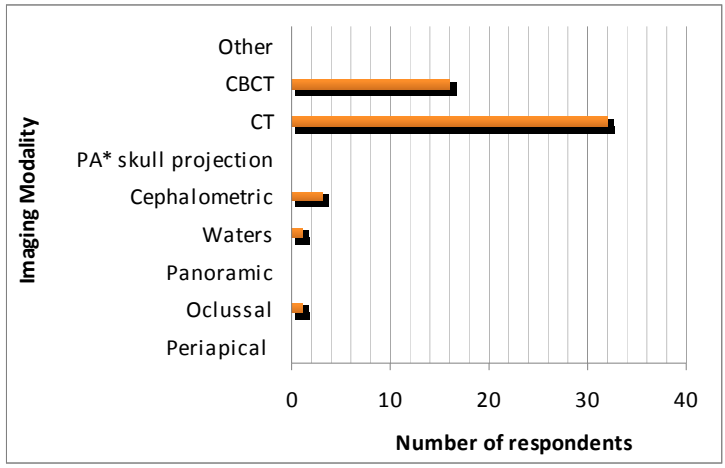

Figure 1. *Residents' perception on the most useful imaging modality in CLP management; *PA: posteroanterior*

In their clinical practice with CLP patients, approximately two thirds (63.6%) of the interviewed residents would opt for simultaneous indication of 2 or 3 imaging techniques – of which at least one is a 3D imaging modality (80% of cases). Again, fewer Plastic surgery and reconstructive microsurgery residents opted for CBCT, compared to the other three medical specialties (pairwise t-test, 95% confidence interval). When comparing the prescription of digital and conventional 2D imaging modalities, no statistically significant difference was found. Nevertheless, fewer Plastic surgery and reconstructive microsurgery residents opted for digital techniques, compared to their colleagues (pairwise t-test, 95% confidence interval).

Section III of the questionnaire

Most of the residents considered that they cannot interpret correctly CT and CBCT examinations (78.2%, respectively 83.6%).

More than half of the respondents (*Table 4*) self-assessed their level of knowledge on the interpretation of 3D imaging results as being very low or low (54.6% in the case of CT, respectively 74.5% for CBCT).

Table 4. *Residents' perceptions of their knowledge in 3D imaging interpretation*

Level of knowledge on interpretation			
		CT	CBCT
Total	N	55	55
	%	100.0	100.0
1-Very low	N	15	29
	%	27.3	52.7
2-Low	N	15	12
	%	27.3	21.8
3-Medium	N	20	10
	%	36.4	18.2
4-High	N	4	3
	%	7.3	5.5
5-Very high	N	1	1
	%	1.8	1.8

Table 5. *Mean scores on 5 points scale*

Level of knowledge on interpretation			
		CT	CBCT
Valid N		55	55
Mean		2.29	1.82
Minimum		1	1
Maximum		5	5
Std. Dev.		1	1

The calculated mean scores for the self-assessed level of knowledge on interpreting 3D imaging results are showed in *Table 5*. The score regarding CT results interpretation was significantly higher when compared to CBCT (pairwise t-test, 95% confidence interval).

Discussion

The recognition of the effects of radiation in children has conducted to substantial effort to educate physicians to request only indicated imaging modalities, in order to reduce radiation exposure from diagnostic medical imaging and respect the ALARA (As Low As Reasonably Achievable) principle (Farman, 2005; Fazel *et al*., 2009; Slovis, 2011; Goske, Strauss, Westra & Frush, 2014). Previous studies have reported cumulative radiation exposure to increase the risk of cancer and other pathologies among children (Holmberg *et al*., 2010; Khong *et al*., 2013; Miglioretti *et al*., 2013).

Also, previous studies have shown various psychological difficulties – stress, anxiety, depression - among children with CLP and their parents, related to satisfaction with facial appearances, concerns on the quality of health care provided and their involvement in treatment planning (De Sousa, Devare & Ghanshani, 2009). CLP patients undergo multiple imaging procedures, indicated to examine the size, its position and the structures involved by the cleft. Considering the complexity and the fragmentation of CLP treatment, as well as the young age of the patients, radiation exposure dictates a careful judgment and balance between potential risks and the clinical benefits of each radiologic examination (Fazel *et al*., 2009; Connolly, Racadio & Towbin, 2006). Since a specialized multidisciplinary treatment center for CLP patients in yet not available in Romania, CLP management is conducted by physicians working in different clinics and hospitals. That makes it difficult to access the patient's exposure history, considering the absence of a national radiologic data base and the lack of communication among different medical specialties.

The availability of new technology has allowed 3D imaging, alongside with digital 2D imaging, to become a valuable tool in the preoperative assessment, as well as in the outcome evaluation during different stages of the CLP treatment (Albuquerque, Gaia & Cavalcanti, 2011; Kapila, Conley & Harrell, 2011). The use of the cone beam technique for maxillofacial imaging was reported in the late 1990's (Mozzo, Procacci, Tacconi, Tinazzi Martini & Bergamo Andreis, 1998; Arai, Tammisalo, Iwai, Hashimoto & Shinoda, 1999) and since then, its applications have been growing rapidly, as it offers a lower dosage of radiation exposure compared to the classic CT (Wortche *et al*., 2006; Silva *et al*., 2008). Therefore, the use of CBCT scans instead of classic CT whenever possible, applies as a dose-reduction strategy, contributing to radiation protection and a better medical care for these pediatric patients. Statistical processing of data pooled from the second section of our questionnaire showed that the respondents understand the importance of 3D imaging and indicate these modalities during CLP management. Yet, a noticeable preference of CT over CBCT can be observed. While the results obtained in the third section of the questionnaire indicate low scores for both 3D imaging techniques, a more pronounced lack of knowledge can be observed when referring to CBCT, compared to CT. This may explain the more frequent indication for CT scans, as observed from the answers of the participating residents. Another possible explanation is the more frequent availability of CT units in hospitals, compared to CBCT equipment. The fact that CBCT examinations are not covered by medical assurance may also contribute to the physician's decision making, considering that a large number of CLP patients come from vulnerable families, as it appears from the author's medical practice.

Other results from the second section of the questionnaire showed no statistically significant difference when comparing the indication of digital techniques to that of conventional 2D imaging modalities. This fact highlights another issue

regarding radiation protection, as digital techniques reduce in great measure the radiation dose compared to conventional (analogue) 2D imaging (Shah, Bansal & Logani, 2014).

Our literature research did not reveal previous similar studies conducted in Romania, so we couldn't compared the obtained results with other findings.

Conclusion

Our results indicate the necessity to improve the physicians' awareness on the necessity of high quality health services for CLP patients - as socially disadvantaged children, and pediatric patients in general, but also on the effect of improper radiation on these patients' quality of life.

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